3.0 SENSITIVITY ANALYSIS

Sensitivities of ESAMS FEs for a short-range missile system were examined in order to determine levels of change in outputs so that data requirements to support assessments could be defined. The Table 3.0-1 provides a qualitative summary of both FE and model level sensitivities, which are defined as high, medium, or low (i.e., H, M, L). This table is presented only to give an overall feel of ESAMS sensitivities. The reader should look at the individual sensitivity studies for a better understanding. Individual FEs may be quite sensitive to changes in the parameters examined. For example, range tracking errors were quite sensitive to changes in filter gain yielding range tracking errors as high as 20 meters compared to almost zero tracking errors with the baseline gain. This would get an "H" rating in Table 3.0-1. Model level MOPs like flyout trajectories, miss distances, and resulting kills were unaffected for the conditions examined and the model sensitivity rating is "L".

TABLE 3.0-1. Qualitative Assessment of FE and Model Sensitivities to Parameter Changes

FE Name	Parameter	Range Varied	FE Sensitivity	Model Sensitivity
Flight Path	Target Gs vs Max Range Error	1-6 Gs with <0,5 sec update	L	L
		1-6 Gs with >1.0 sec update	H	L
	Target Path Update Intervals vs Max Range Error	0-2 sec Update Interval	H	H
Fluctuations	Glint	0 - 2 mr Track Error	L	L
	Scintillation	1.0 - 0.001 sq.m. Target RCS	M	L
ECM Off-Board	Chaff	0.1-10 sq. m. Target RCS	H	H
	Towed Decoy Power	0-250dB J/S	H	H
	Towed Decoy Tow Length	50-200 m	H	H
Clutter	Target Altitude	60- 1500 m	M	M-L
	Resolution Length	50-1000m	M-L	L
	Terrain Type	Rural sand-Urban	M	M-L
Waveform Generator	PRF Jitter	0-5% of Pulse Width	H	L
Antenna Gain	Antenna Efficiency	100 - 90%	L	L
	Half Power Angle	1-3 degrees	L	L
	Squint Angle	100 - 50%	L	L
Clutter Rejection	MTI Response	0-25 kHz	H	M
	Doppler Filter Response	Chebyschev Order (1-9)	H	M
Angle Track	Filter Type	IASTYP = 4, 7, 9	H	H
Range Track	Filter Gain	50-200% of Baseline	H	L
Doppler Track	Filter Gain	100-400% of baseline	H	L
Force and Moment Generation	Missile Speed	Mach 0.75-1.5	H	M
	Missile Damping	Damped-undamped	H	L

ESAMS is widely used and suitable for many applications, but the following significant findings are provided for user consideration:

a. Intercept capability of the short-range system tested is very sensitive to target signature. This result is intuitive, however, there is a question as to whether this result was obtained for the right reason. If the acquisition mode in the model, for example, does not replicate the hardware circuitry, its performance against small signature targets (.01 sq.m. and below) is questionable. Additional test data in this low signature regime is needed. Sensitivity of other systems should also be examined.

b. The model is very susceptible to range gate stealing in its normal configuration. Range track sensitivity analysis revealed an excessively wide bandwidth in the range gate simulation, which can account for some, but perhaps not all, of this susceptibility. This bandwidth should be changed to agree with available data.

c. The model has idealized AGC loops that do not capture non-linearities that are known to exist in real systems. In order to accurately simulate response to ECM techniques that rely on exploitation of system circuitry, detailed representation of critical receiver functions should be included.

d. Model sensitivity to excursions in clutter rejection magnitude was not as high as expected. Treatment of clutter in ESAMS should be examined further.